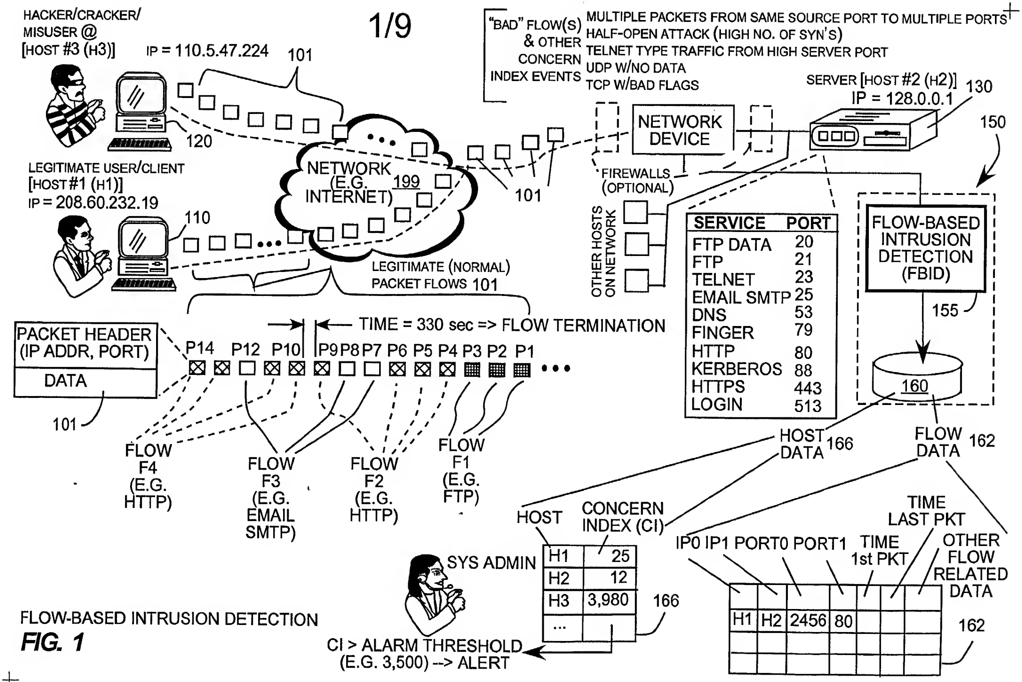
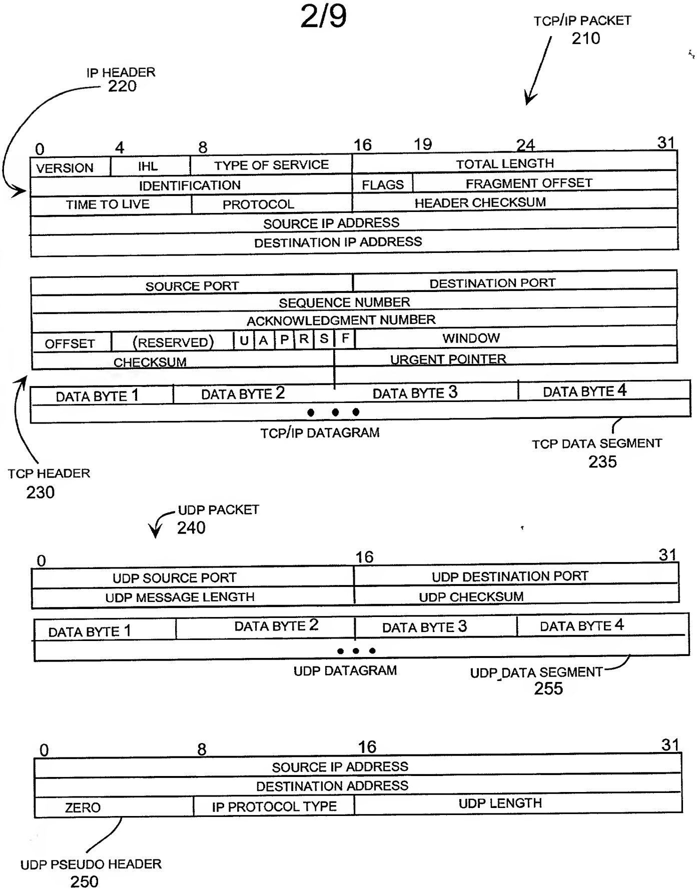


SERVICE	PORT
FTP DATA	20
FTP	21
TELNET	23
EMAIL SMTP	25
DNS	53
FINGER	79
HTTP	80
KERBEROS	88
HTTPS	443
LOGIN	513

FLOW-BASED INTRUSION DETECTION

FIG. 1



PACKET HEADERS
FIG. 2

TCP/IP SESSION
300

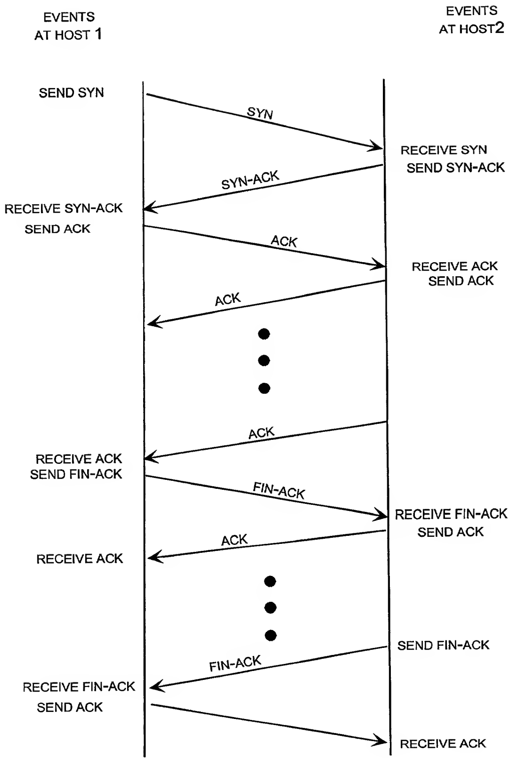


FIG. 3

FLOWS

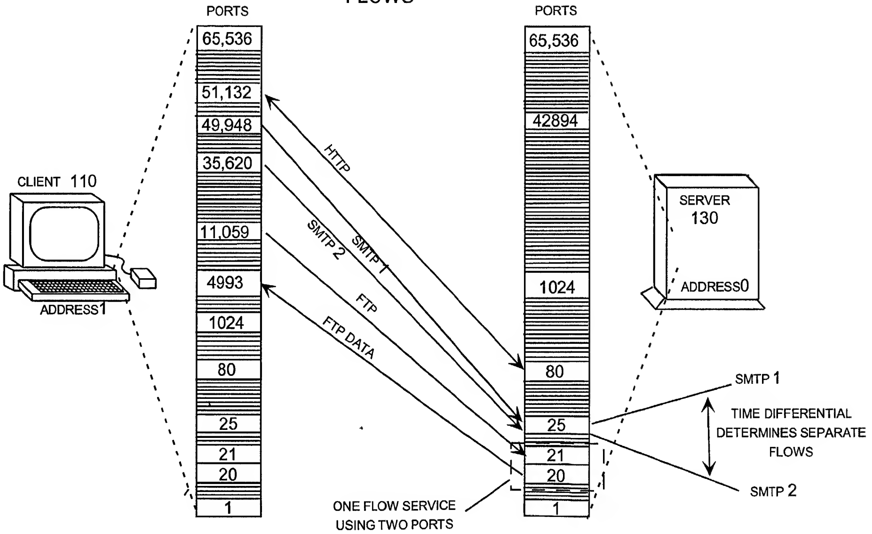
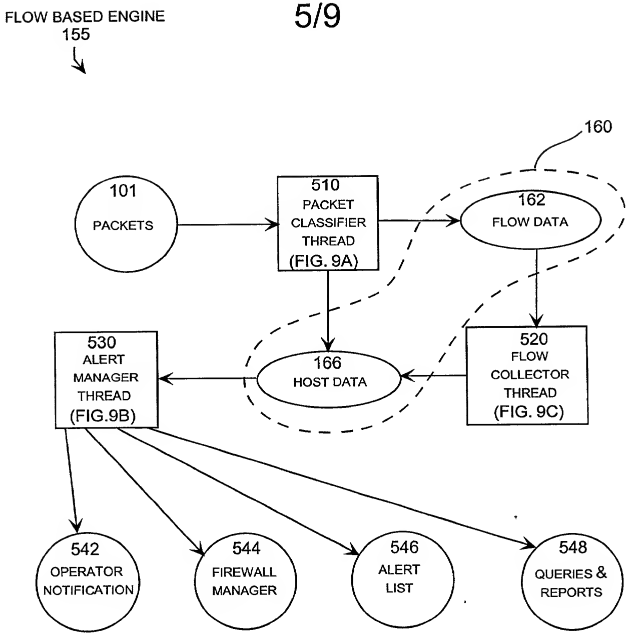

PORTS
65,536
51,132
49,948
35,620
11,059
4993
1024
80
25
21
20
1
CLIENT 110
ADDRESS1
HTTP
SMTP 1
SMTP 2
FTP
FTP DATA
PORTS
65,536
42894
1024
80
25
21
20
1
SERVER 130
ADDRESS0
SMTP 1
TIME DIFFERENTIAL DETERMINES SEPARATE FLOWS
SMTP 2
ONE FLOW SERVICE USING TWO PORTS

FIG. 4



PROGRAM THREADS: SQUARES

DATA STRUCTURES: OVALS

DATA INPUT/OUTPUT: CIRCLES

FIG. 5

TABLE I

NAME	POTENTIAL INTRUDER	RESPONSE	CI VALUE
POTENTIAL TCP PROBE	TCP PACKETS	RESET PACKETS	NUMBER OF PACKETS
POTENTIAL UDP PROBE	UDP PACKEST	ICMP PORT UNAVAILABLEPCKETS	NUMBER OF ICMP PORT UNAVAILABLE PACKETS
HALF-OPEN ATTACK	HIGH NUMBER AND RATE OF SYNS	SYN-ACKS	5000+501 PER SYN-ACK
TCP STEALTH PORT SCAN	MULTIPLE PACKETS FROM SAME SOURCE PORT TO DIFFERENT DESTINATION PORTS	RESETS	8000+1010 PER PORT OVER 4
UDP STEALTH PORT SCAN	MULTIPLE PACKETS FROM SAME SOURCE PORT TO DIFFERENT DESTINATION PORTS	NOTHING OR ICMP PORT UNAVAILABLE	8000+1010 PER PORT OVER 4

FLOW-BASED CI VALUES

FIG. 6

TABLE II

NAME	POTENTIAL INTRUDER	RESPONSE	CI VALUE
BAD FLAGS	TCP PACKET WITH UNDEFINED FLAGS		200
SHORT UDP	UDP PACKET LESS 2 DATA BYTES		200
ADDRESS SCAN	PACKETS TO MORE THAN 8 HOSTS ON SAME SUBNET	NOTHING OR RESETS	3000 PER DETECT
PORT SCAN	PACKETS TO MORE THAN 4 PORTS	RESETS	1010 PER PORT OVER 4

CI EVENT VALUES

FIG. 7

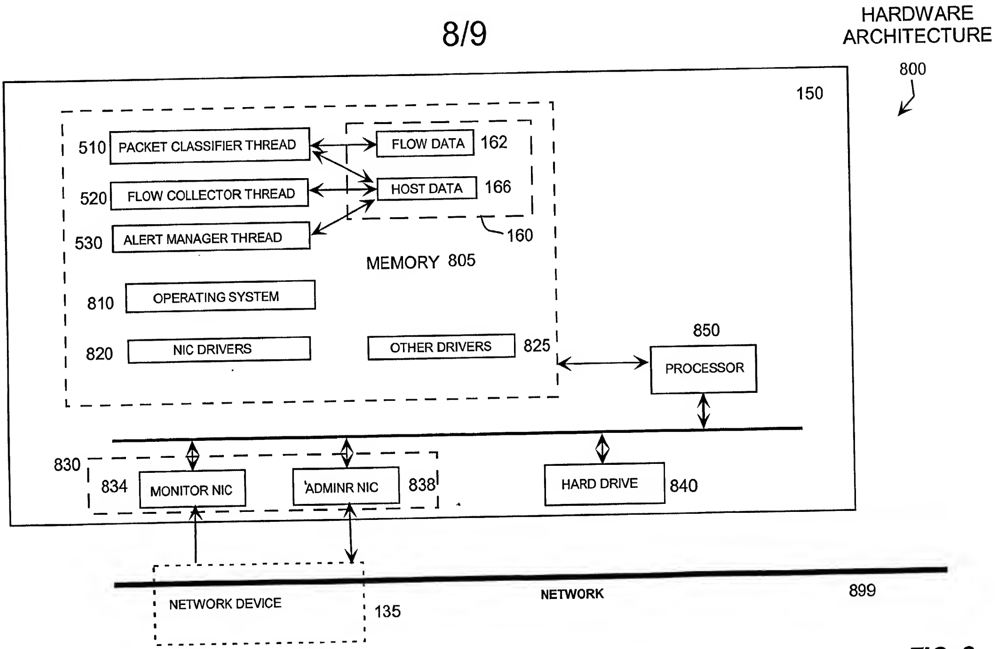

HARDWARE ARCHITECTURE
800
150
510 PACKET CLASSIFIER THREAD
520 FLOW COLLECTOR THREAD
530 ALERT MANAGER THREAD
FLOW DATA 162
HOST DATA 166
160
MEMORY 805
810 OPERATING SYSTEM
820 NIC DRIVERS
OTHER DRIVERS 825
850
PROCESSOR
830
834 MONITOR NIC
ADMINR NIC 838
HARD DRIVE 840
NETWORK DEVICE
135
NETWORK
899

FIG. 8

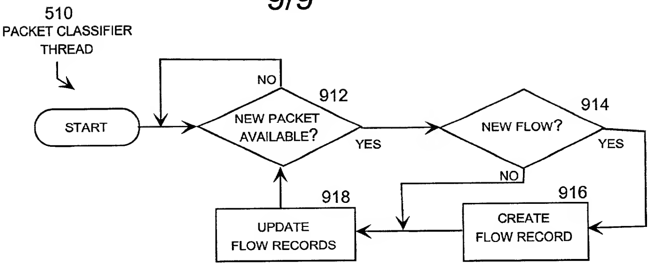


FIG. 9A

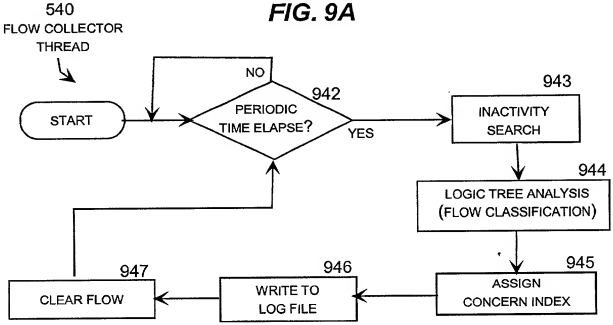


FIG. 9B

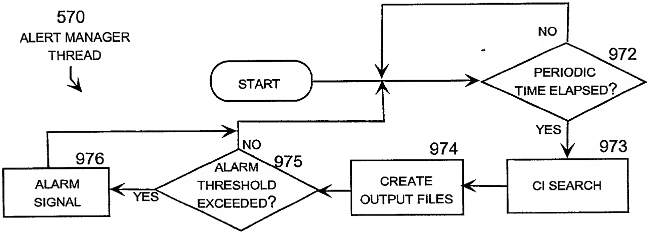


FIG. 9C